

CLAIMS:

1. An exhaust gas deNOx apparatus for an engine comprising
5 an NOx adsorber catalyst in an exhaust pipe line of an engine,
for adsorbing NOx when an air fuel ratio of an exhaust gas
flowing therein is in a lean state and releasing NOx when the
air fuel ratio of the exhaust gas flowing therein is in a rich
state, and
10 an exhaust gas recirculating circuit for mixing the exhaust gas
into intake air, comprising:
exhaust gas recirculating amount control means for
recirculating a predetermined amount of exhaust gas for
reducing NOx when an adsorbed NOx accumulation amount is
15 not more than a predetermined value, and recirculating said
predetermined amount or more of exhaust gas to bring the air
fuel ratio into a rich state when the adsorbed NOx
accumulation amount exceeds the predetermined value and the
NOx is to be released.
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2. The exhaust gas deNOx apparatus for the engine
according to Claim 1,
wherein said exhaust gas recirculating amount control
means is capable of adjusting an exhaust gas recirculating
25 amount, which is fed when the air fuel ratio of the exhaust gas

flowing into said NOx adsorber catalyst is brought into a rich state, so that an excess air ratio is more than 1.0 and is about 1.3 or less.

- 5 3. The exhaust gas deNOx apparatus for the engine according to Claim 1 or Claim 2,

 wherein said exhaust gas recirculating amount control means comprises

- at least any one of an intake air throttle valve free to be
10 opened and closed, which is provided in a pipe line of an intake pipe of said engine, and an exhaust gas throttle valve free to be opened and closed, which is provided in a pipe line of an exhaust pipe of said engine, and
 a controller,

- 15 wherein said controller outputs a control signal for decreasing degree of opening of either one of said intake air throttle valve or said exhaust gas throttle valve when the air fuel ratio of the exhaust gas is to be brought into a rich state.

- 20 4. The exhaust gas deNOx apparatus for the engine according to Claim 1 or Claim 2,

- wherein said exhaust gas recirculating circuit comprises a first exhaust gas recirculating circuit and at least one second exhaust gas recirculating circuit provided in
25 parallel with said first exhaust gas recirculating circuit,

wherein said exhaust gas recirculating amount control means comprises

a second recirculating circuit adjusting valve free to be opened and closed, which is provided in said second exhaust gas

5 recirculating circuit,

NOx amount detection means for detecting an NOx amount, and

a controller for calculating an NOx accumulation amount in said NOx adsorber catalyst based on the NOx amount outputted
10 from said NOx amount detection means and determining whether said calculated NOx accumulation amount is a predetermined value or less, or not, and

wherein when said calculated NOx accumulation amount exceeds the predetermined value, said controller
15 outputs a control signal to open said second recirculating circuit adjusting valve to make the air fuel ratio of the exhaust gas of said engine rich.

5. The exhaust gas deNOx apparatus for the engine
20 according to Claim 4,

wherein said exhaust gas recirculating amount control means comprises at least one of an intake air throttle valve free to be opened and closed, which is provided in a pipe line of an intake pipe of said engine, and an exhaust gas throttle
25 valve free to be opened and closed, which is provided in a pipe

line of an exhaust pipe of said engine,

wherein said controller further outputs a control signal for decreasing degree of opening of any one of said intake air throttle valve and said exhaust gas throttle valve when the air
5 fuel ratio of the exhaust gas of said engine is to be made rich.

6. The exhaust gas deNOx apparatus for the engine according to Claim 4, further comprising:

a turbocharger provided at said engine; and
10 an air bleed valve free to be opened and closed, which is provided at an outlet port of a compressor of said turbocharger, extracts supply air to an outside and constitutes said exhaust gas recirculating amount control means,

wherein said controller further outputs a control signal
15 to open said air bleed valve when the air fuel ratio of the exhaust gas of said engine is to be made rich.

7. The exhaust gas deNOx apparatus for the engine according to Claim 1 or Claim 2,

20 wherein said exhaust gas recirculating circuit comprises a third exhaust gas recirculating circuit provided with a plurality of recirculating circuit adjusting valves in parallel,

wherein said exhaust gas recirculating amount control
25 means comprises

said plurality of recirculating circuit adjusting valves,
NOx amount detection means for detecting an NOx amount,
and

a controller for calculating an NOx accumulation amount in
5 said NOx adsorber catalyst based on the NOx amount outputted
from said NOx amount detection means and determining
whether said calculated NOx accumulation amount is a
predetermined value or less, or not, and

wherein when said calculated NOx accumulation
10 amount exceeds a predetermined value, said controller outputs
a control signal to increase a total opening area of said
plurality of recirculating circuit adjusting valves to be larger
than that in a lean state and makes the air fuel ratio of the
exhaust gas of said engine rich.

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8. The exhaust gas deNOx apparatus for the engine
according to Claim 7,

wherein said exhaust gas recirculating amount control
means comprises at least one of an intake air throttle valve
20 free to be opened and closed, which is provided in a pipe line
of an intake pipe of said engine, and an exhaust gas throttle
valve free to be opened and closed, which is provided in a pipe
line of an exhaust pipe of said engine,

wherein said controller further outputs a control signal
25 to decrease degree of opening of either one of said intake air

throttle valve or said exhaust gas throttle valve when the air fuel ratio of the exhaust gas is to be made rich.

9. The exhaust gas deNOx apparatus for the engine
5 according to Claim 7, further comprising:
a turbocharger provided at said engine; and
an air bleed valve free to be opened and closed, which
is provided at an outlet port of a compressor of said
turbocharger, extracts supply air to an outside and constitutes
10 said exhaust gas recirculating amount control means,
wherein said controller further outputs a control signal
to open said air bleed valve when the air fuel ratio of the
exhaust gas of said engine is to be made rich.

- 15 10. The exhaust gas deNOx apparatus for the engine
according to Claim 1 or Claim 2,
wherein a turbocharger is provided at said engine, and
wherein said exhaust gas recirculating amount control
means comprises
20 an air bleed valve free to be opened and closed, which is
provided at an outlet port of a compressor of said turbocharger
and extracts supply air to an outside, and
a controller for outputting a control signal to open said air
bleed valve when the air fuel ratio of the exhaust gas of said
25 engine is to be made rich.

11. The exhaust deNOx apparatus for the engine according to Claim 1 or Claim 2,

wherein said exhaust gas recirculating amount control means comprises fuel supply means for supplying fuel into at least one of cylinders of said engine and an exhaust pipe of said engine,

wherein when the air fuel ratio of the exhaust gas is to be brought into a rich state, said fuel supply means supplies fuel as an adjustment amount to provide an air fuel ratio that allows said NOx adsorber catalyst to release and reduce NOx.

12. The exhaust gas deNOx apparatus for the engine according to Claim 4,

wherein said exhaust gas recirculating amount control means comprises fuel supply means for supplying fuel into at least one of cylinders of said engine and an exhaust pipe of said engine, and

wherein when the air fuel ratio of the exhaust gas is to be brought into a rich state, said fuel supply means supplies fuel as an adjustment amount to provide the air fuel ratio that allows said NOx adsorber catalyst to release and reduce NOx.

13. The exhaust gas deNOx apparatus for the engine according to Claim 7,

wherein said exhaust gas recirculating amount control means comprises fuel supply means for supplying fuel into at least one of cylinders of said engine and an exhaust pipe of said engine, and

5 wherein when the air fuel ratio of the exhaust gas is to be brought into a rich state, said fuel supply means supplies fuel as an adjustment amount to provide the air fuel ratio that
allows said NOx adsorber catalyst to release and reduce NOx.

10 14. The exhaust gas deNOx apparatus for the engine according to Claim 1 or Claim 2, further comprising:

 wherein said exhaust gas recirculating amount control means comprises load detection means for detecting a load of said engine; and a controller, and

15 wherein said controller inputs a detection signal from said load detection means, and when the detected load is a predetermined value or less, it brings the air fuel ratio of the exhaust gas into a rich state.

20 15. The exhaust gas deNOx apparatus for the engine according to Claim 1 or Claim 2,

 wherein said exhaust gas recirculating amount control means comprises a variable turbocharger provided at said engine, for making a degree of opening of a turbine passage

25 variable, and a controller, and

wherein when the air fuel ratio of the exhaust gas is to be brought into a rich state, said controller outputs a control signal to decrease the degree of opening of said turbine passage.

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16. The exhaust gas deNOx apparatus for the engine according to Claim 4,

wherein said exhaust gas recirculating amount control means comprises a variable turbocharger provided at said engine, for making a degree of opening of the turbine passage variable, and

wherein when the air fuel ratio of the exhaust gas is to be brought into a rich state, said controller outputs a control signal to decrease the degree of opening of said turbine passage.

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17. The exhaust gas deNOx apparatus for the engine according to Claim 16,

wherein said exhaust gas recirculating amount control means comprises fuel supply means for supplying fuel into at least one of cylinders of said engine and an exhaust pipe of said engine, and

wherein when the air fuel ratio of the exhaust gas is to be brought into a rich state, said fuel supply means supplies fuel as an adjustment amount to provide the air fuel ratio

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which allows said NOx adsorber catalyst to release and reduce NOx.
